What is claimed is:

1. A node control device which is disposed in each node device constituting an optical network system, and is used for controlling the packet transfer operation in each node device, comprising:

edge/core determination means for determining whether a node device which the node control device is controlling (hereafter to be referred to as the present node device) is a transmission side edge node device, a core node device, or a destination side edge node device for the transfer packet which is to be processed;

cut-through request packet processing means wherein which, when said present node device is the destination side edge node device, notifies the open resource information of said present node device to the upstream side of the transfer route as a cut-through request packet, and, when said present node device is the core node device, transfers the cut-through request packet after adding thereto the open resource information of said present node device which is received from the downstream side of the transfer route or is individually generated;

optical path allocation request packet processing means for determining the optimum allocation of the optical path based on the open resource information of the cut-through request packet transferred to the transmission side edge node device, and notifying the allocation to the target transmission side edge node device, core node device, and destination side edge node

device respectively by an optical path allocation request packet; and

optical path switching control means for controlling an optical switch according to the allocation notified by the optical path allocation request packet, setting an optical path which omits the layer 2 and 3 processing, and notifying the completion to the transmission side edge node device by an optical path setting completion notice packet.

2. A node control device which is disposed in each node device constituting an optical network system and is used for controlling the packet transfer operation in each node device, comprising:

edge/core determination means for determining whether a node device which the node control device is controlling (hereafter to be referred to as the present node device) is a transmission side edge node device, a core node device, or a destination side edge node device for the transfer packet to be processed;

cut-through request packet processing means which, when said present node device is the transmission side edge node device, notifies the open resource information of said present node device to the downstream side of the transfer route as a cut-through request packet, and when said present node device is the core node device, transfers the cut-through request packet after adding thereto the open resource information of said present node device which is received from the upstream side of the transfer route or is individually generated;

optical path allocation request packet processing means for determining an optimum allocation of the optical path based on the open resource information of the cut-through request packet transferred to the destination side edge node device, and notifying the allocation to the target transmission side edge node device, core node device, and destination side edge node device respectively by an optical path allocation request packet; and

optical path switching control means for controlling an optical switch according to the allocation notified by the optical path allocation request packet, setting an optical path which omits the layer 2 and 3 processing, and notifying the completion to the transmission side edge node device by an optical path setting completion notice packet.

3. A node control device which is disposed in each node device constituting an optical network system, and is used for controlling the packet transfer operation in each node device, comprising:

edge/core determination means for determining whether a node device which the node control device is controlling (hereafter to be referred to as the present node device) is a transmission side edge node device, a core node device, or a destination side edge node device for the transfer packet to be processed;

cut-through setting packet processing means which, when said present node device is the destination side edge node device, notifies the open resource information of said present

node device to the upstream side of the transfer route as a cut-through setting packet, and when said present node device is the core node device, determines whether cut through by the open resource indicated in the cut-through setting packet received from the downstream side of the transfer route is possible, and if possible, transfers received cut-through setting packet to the upstream side of the transfer route after adding the information to the cut-through setting packet, and if impossible, transfers received cut-through setting packet to the upstream side of the transfer route after adding thereto the cut-through information which has been set thus far and the open resource information of said present node device; and

optical path switching control means which, when said cut-through setting packet processing means determines that cut through is possible, controls an optical switch so as to set an optical path to the resource for which it was determined that cut through is possible.

4. A node control device which is disposed in each node device constituting an optical network system, and is used for controlling the packet transfer operation in each node device, comprising:

edge/core determination means for determining whether a node device which the node control device is controlling (hereafter to be referred to as the present node device) is a transmission side edge node device, a core node device, or a destination side edge node device for the transfer packet to be processed;

cut-through setting packet processing means which, when said present node device is the transmission side edge node device, notifies the open resource information of said present node device to the downstream side of the transfer route as a cut-through setting packet, and when said present node device is the core node device, determines whether cut through by the open resource indicated in the cut-through setting packet received from the upstream side of the transfer route is possible, and if possible, transfers the received cut-through setting packet to the downstream side of the transfer route after adding the information to the cut-through setting packet, and if impossible, transfers the received cut-through setting packet to the downstream side of the transfer route after adding thereto the cut-through information which has been set thus far and the open resource information of said present node device; and

optical path switching control means which, when said cut-through setting packet processing means determines that cut through is possible, controls an optical switch so as to set an optical path to the resource for which it was determined that cut through is possible.

5. The node control device according to Claim 1, further comprising forced releasing means for forcibly releasing the optical path when a predetermined time has elapsed since setting of the optical path, or when a decrease in the number of communication packets is confirmed at the node device positioned at both ends of said optical path.

6. The node control device according to Claim 1, further comprising cut-through optical path necessary/unnecessary determination means for determining the necessity of cut through before transmitting the cut-through request packet or transmitting the cut-through setting packet, so that the cut-through optical path is selectively set only when determined as necessary.

7. The node control device according to Claim 1, further comprising information channel insuring means for determining whether the information channel is continuously insured after setting the cut-through optical path between the node devices on the route where the cut-through optical path is set before transmitting the cut-through request packet or transmitting the cut-through setting packet, and setting the cut-through optical path only when the information channel is insured.

8. A node device comprising:

a router for determining the output destination of a transfer packet which is input according to the header information of the layer 3;

an optical cross-connect for extracting (dropping) optical signals from an optical fiber or inserting (adding) optical signals to an optical fiber, or relaying optical signals between arbitrary input/output optical fibers for optical path setting; and

a node control device according to Claim 1 for switching a connected pair of each input port and output port

inside said optical cross-connect according to the instructions of the received transfer packet or based on self judgment.

9. The node device according to Claim 8, further comprising a switch which connects a destination-based buffer to some of the outputs from said router to said optical cross-connect, and can connect a packet read from said destination-based buffer to an arbitrary input port of said optical cross-connect.

10. The node device according to Claim 9, further comprising allowable delay recognition function means provided in said router for determining the allowable delay of a transfer packet, so that only packets with a large allowable delay are allowed to be output to said destination-based buffer and packets with a small allowable delay are directly output to said optical cross-connect.

11. A node device comprising:

a router for determining the output destination of a transfer packet which is input according to the header information of the layer 3;

an optical cross-connect for extracting (dropping) optical signals from an optical fiber, or inserting (adding) optical signals into an optical fiber, or relaying optical signals between arbitrary input/output optical fibers for optical path setting;

a node control device according to Claim 1 for switching a connected pair of each input port and output port

inside said optical cross-connect according to the instructions of the received transfer packet or based on self judgment; and

optical path extraction/insertion (drop/add) means for the information channel for extracting (dropping) optical signals with a fixed wavelength insured for the information channel from the optical fiber, or for inserting (adding) said optical signals with a fixed wavelength into the optical fiber, so as to enable communication of information signals with another node device.

12. A node device comprising:

a router for determining the output destination of a transfer packet which is input according to the header information of the layer 3;

an optical cross-connect for extracting (dropping) optical signals from an optical fiber, or inserting (adding) optical signals into an optical fiber, or relaying optical signals between arbitrary input/output optical fibers for optical path setting;

a node control device according to Claims 1 for switching a connected pair of each input port and output port inside the optical cross-connect according to the instructions of the received transfer packet or based on self judgment; and

pilot tone signal transmission means for the information channel for overlaying pilot tone signals for the information channel on the optical path for user data or separating pilot tone signals for the information channel from

the optical path for user data so as to enable communication of information signals with another node device.

13. The node device according to Claim 12, wherein said pilot tone signals for the information channel are transmitted by a time division multiplex system.

14. An optical network system comprising a plurality of the node devices according to Claim 8.

15. An optical path setting method in an optical network system comprising:

a step where a destination side edge node device which confirmed the transfer of a packet to a terminal accommodated by the present node device or an access system network notifies the open resource information of said present node device to the transmission side edge node device;

a step where the transmission side edge node device determines an optimum allocation of an optical path to be set on the transfer route based on the open resource information notified by the destination side edge node device and the core node device; and

a step where the transmission side edge node device, the core node device and the destination side edge node device set the optical path which omits the packet transfer processing (layer 2 and layer 3 processing) in transit nodes for the optical path determined in the previous step.

16. An optical path setting method in an optical network system comprising:

a step where a transmission side edge node device which confirmed the transfer of a packet to the destination notifies the open resource information of the present node device to a destination side edge node device;

a step where the destination side edge node device determines the optimum allocation of the optical path to be set on the transfer route based on the open resource information notified by the transmission side edge node device and the core node device; and

a step where the transmission side edge node device, the core node device and the destination side edge node device set the optical path which omits the packet transfer processing (layer 2 and layer 3 processing) in transit nodes for the optical path determined in the previous step.

17. An optical path setting method in an optical network system, comprising:

a step where a destination side edge node device which confirmed the transfer of a packet to a terminal accommodated by the present node device or to an access system network transmits the open resource information of said present node device to a transmission side edge node device which is at the upstream side; and

a step where a core node device and a transmission side edge node device, to which said open resource information is transferred, determine respectively whether the setting of a cut-through optical path is possible based on the open resource information received from the downstream side of the present node

device, and if possible, the core node device and the transmission side edge node set the cut-through optical packet using the resource which was determined as possible, and notify the information to the upstream side, and if impossible, the core node device and the transmission side edge node device add the cut-through information which has been set thus far and the open resource information of the present node device to the received open resource information, and transfer it to the upstream side.

18. An optical path setting method in an optical network system, comprising:

a step where a transmission side edge node device which confirmed the transfer of a packet to a destination transmits the open resource information of the present node device to a transmission side edge node which is at the downstream side; and

a step where a core node device and the destination side edge node device to which said open resource information is transferred determine respectively whether the setting of a cut-through optical path is possible based on the open resource information received from the upstream side of the present node device, and if possible, the core node device and the destination side edge node device set the cut-through optical packet using the resource which was determined as possible, and notify the information to the downstream side, and if impossible, the core node device and the destination side edge node device add the cut-through information which has been set thus far and the open resource information of the present node device to the received

open resource information, and transfer it to the downstream side.

19. The optical path setting method according to Claim 15, wherein the optical path is forcibly released when a predetermined time has elapsed since the setting of the optical path, or when a decrease in the number of communication packets is confirmed at the node device positioned at both ends of the optical path.

20. The optical path setting method according to Claim 15, wherein the necessity of cut through is determined before setting the cut-through optical path, and the setting processing is continued only when the necessity is determined.

21. The optical path setting method according to Claim 15, wherein it is determined whether the information channel is continuously insured after setting the cut-through optical path between the node devices on the route where the cut-through optical path is set before setting the cut-through optical path, and the cut-through optical path is set only when the information channel is insured.

22. The optical path setting method according to Claim 15, wherein a packet read from the destination-based buffer is transmitted to the cut-through optical path after setting.

23. The optical path setting method according to Claim 22, wherein only packets with a large allowable delay are stored in said destination-based buffer.

24. The optical path setting method according to Claim 15, wherein the information communication between the node devices,

where the cut-through optical path is set, is implemented using optical signals with a fixed wavelength insured for the information channel after the cut-through optical path is set.

25. The optical path setting method according Claim 15, wherein the pilot tone signal for the information channel is overlaid on the optical path for user data to implement information communication between the node devices, where the cut-through optical path is set, after the cut-through optical path is set.

26. The optical path setting method according to Claim 25, wherein said pilot tone signals for the information channel are transmitted in the time division multiplex system.

27. An optical network system comprising:

a plurality of edge node devices which are designed as dedicated for respective edge nodes; and

one or more core node devices which are connected between said plurality of edge node devices via a transfer route and are designed as dedicated for respective core nodes;

wherein said edge node device is connected only between an external terminal, etc. and the core node device; and

said core node device is connected only with both or one of said edge node device and another core node device, and has core node input/output ports for forwarding a transfer packet with the other core node device but does not have input/output ports for forwarding a transfer packet with an external terminal.

28. The optical network system according to Claim 27, wherein the transfer packets are packets including a user packet

and a control packet; and said edge node device further comprises:

input/output part having edge node input/output ports for forwarding said transfer packet with said core node device;

an edge node router which has input/output ports, decides the output destination of said transfer packet which was input from said input/output ports in accordance with the header information of layer 2 and layer 3 and outputs the output destination to said input/output part; and

an edge node control function part which controls the decision of said output destination in said router for said user packet which was input according to the instruction of said control packet which was input;

and said core node device further comprises:

an optical cross-connect which has code node input/output ports for forwarding said transfer packet with said edge node device and with said other core node devices, and sets an optical path between said core node input/output ports;

a cord node router which outputs an output destination of a transfer packet which was input from said core node input/output ports according to the header information of layer 2 and layer 3, and outputs the output destination to said core node input/output part; and

a core node control function part which decides said output destination in said core node router for said user packet which was input according to the instruction of said control packet which was input, and controls the switching of a connected

pair of each input port and output port inside said optical cross-connect.

29. The optical network system according to Claim 28, wherein said edge node control function part further comprises:

a cut-through request packet processing part which, when a user packet from the transmission origination edge node device is input, notifies open source information of the self edge node device as a cut-through request packet to the transmission origination edge node device;

an optical path allocation request packet processing part which, when a cut-through request packet is input from a destination side edge node device, decides an optimum allocation of an optical path based on the open resource information written in said cut-through request packet, and notifies said allocation to said core node device and said destination side edge node device as an optical path allocation request packet; and

an edge node router control part which, when a cut-through optical path is set in said core node device and said destination side edge node device, controls said edge node router so that the user packet is transferred via said cut-through optical path;

and said core node control function part further comprises:

a cut-through request packet process part which adds open resource information in the self core node device to the cut-through request packet which is received from an upstream

side or is generated individually, and transfers it to the upstream side;

an optical path switching control part which sets a cut-through optical path in said optical cross-connect according to the instruction of said optical path allocation request packet notified by said edge node device; and

a core node router control part which, when a cut-through optical path is set in one of the core node devices and the destination side edge node device, controls said router so that the user packet is transferred via said cut-through optical path.

add A'

add B'